PROGRIS RIPORT 14

Taro Kotani
小谷 太郎

010322

`itehu:~kotani/glast/txt/010322.kotani2.riport14`

1 Have Done

- Removed side rows to see what happens to backsplashes.
- Investigated on the nature of the electron events with an initial vertex inside the tracker.
- Improved the initial-vertex filter to utilize ACD information.
- Submitted a proposal for Chandra a few minutes before the deadline.

2 Remove the Row

In Fig. 1 in Riport 12 are the No_Vetos_Hit distributions of 300 GeV photons and electrons plotted. Is this syntactically correct? I remove the rows of the side tiles one by one and see what happens to the number of ACD hits. You may think that you can avoid to re-run simulations because the data you already have are available, and that all you have to do is to remove certain hits from the data. That's wrong. The data i have don't have the information on the identification of the hit tiles. So i modified some GLASTSIM codes to output the information on up to 50 ACD hits and generated ten thousand events for debugging and for the study and here is the result. The No_Vetos_Hit distributions of 300 GeV photons are shown in Fig. 1-5. An heavenly origin is assumed. Events with more than 50 ACD hits are neglected. As expected, the population of events without any hits or with few hits increases as the rows are removed. However, 60 % of the 300 GeV photons of a cosmic origin makes one or more hits even if there are no side tiles.

3 Initial Vertexes in the TKR

In Fig. 3 in Riport 13, you see many initial vertexes of electron inside the tracker. That's strange. If everything is going well, all initial vertexes should be found at the edges, i.e., on the surface of teh tracker. I have examined some of those initial vertexes and found two cases:

- An incident electron from side directly hits the calorimeter, and the daughter particles leave tracks in the tracker, then the logic picks up a track as the best track.
- An incident electron from top or side sneaks between trackers and then enter a tracker tower.

An example of the former is shown in Fig. 6. This kind of events was not cut by the current initial-vertex filter and occupies a major fraction of remaining events. An example of the 2nd type is shown in Fig. 7. These events are not difficult to remove, i thought. There may be other class of events with an initial vertex inside the tracker, and the investigation is going on.

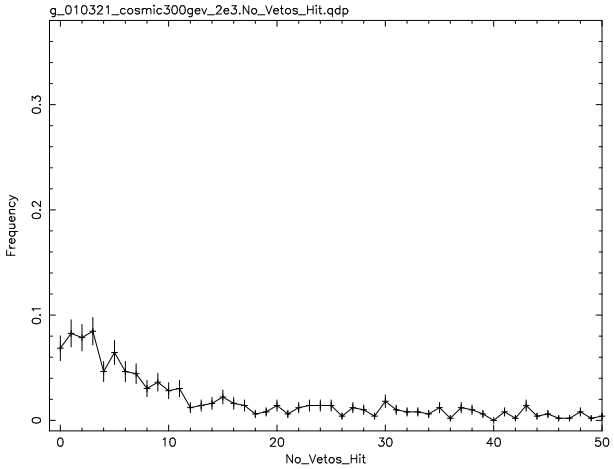

Figure 1: The No_Vetos_Hit distribution with 4 rows Almost same as Fig. 1 in Riport 12.

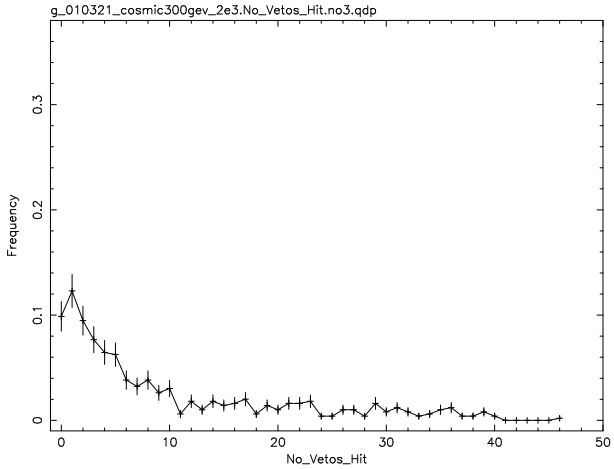

Figure 2: The No_Vetos_Hit distribution with 3 rows Same data as in Fig 1 are used. Hits on the 4th row are not counted.

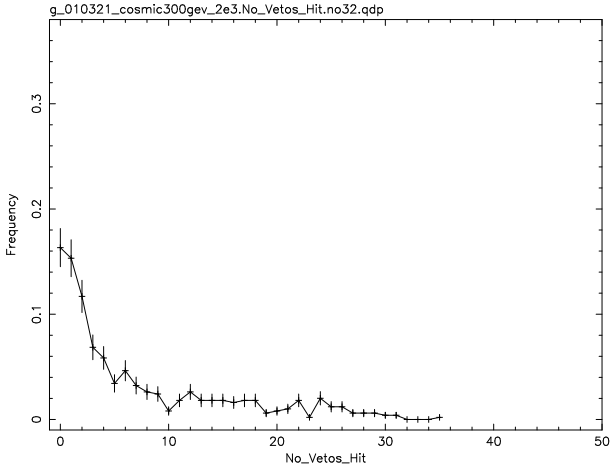

Figure 3: The No_Vetos_Hit distribution with 2 rows Same data as in Fig 1 are used. Hits on the 3rd and 4th row are not counted.

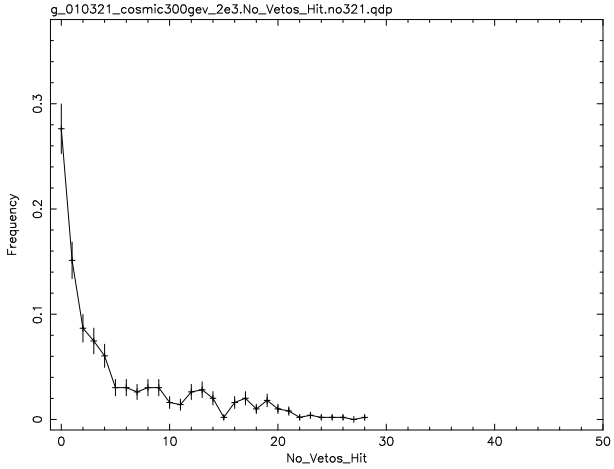

Figure 4: The No_Vetos_Hit distribution with 1 rows Same data as in Fig 1 are used. Hits on the 2nd, 3rd, and 4th row are not counted.

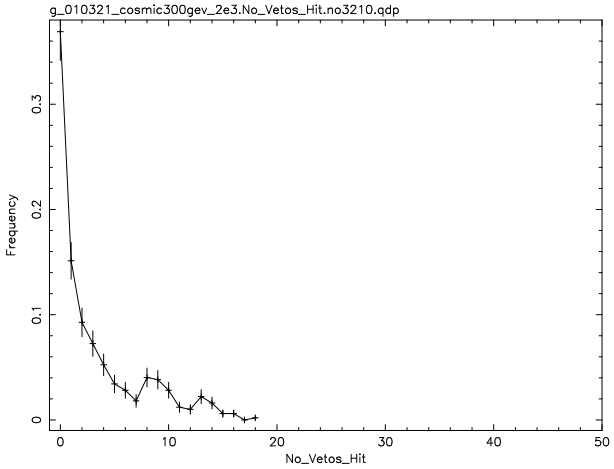

Figure 5: The No_Vetos_Hit distribution with no rows
Same data as in Fig 1 are used. Hits on the 1st, 2nd, 3rd, and 4th row are not counted.

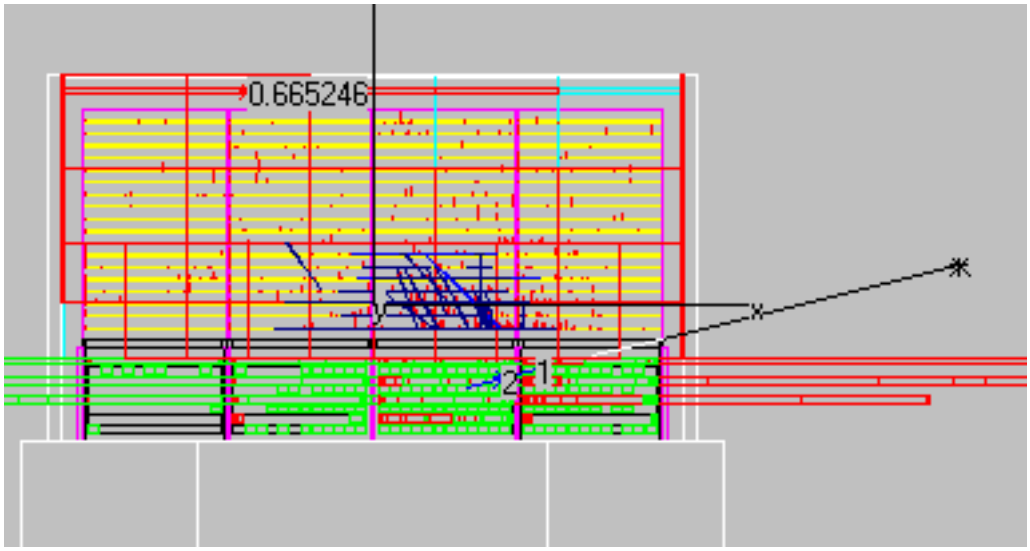

Figure 6: An electron from side
A 300 GeV cosmic electron from side hits a bottom ACD tile, enters through the space between the tracker and the calorimeter, and hits the calorimeter. The track of a daughter particle (which?) is recognized as the best track by the logic.

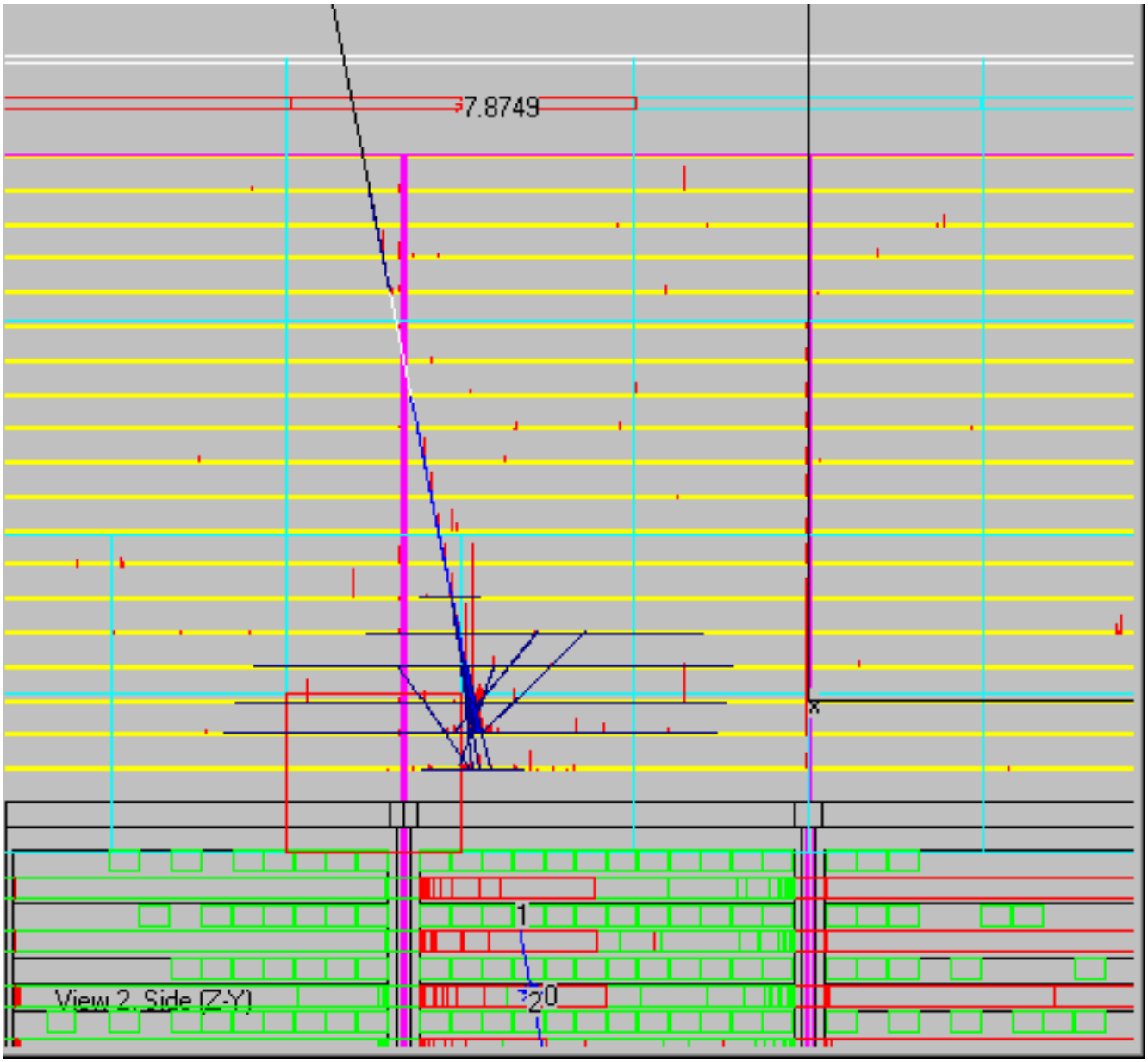

Figure 7: An electron between trackers
A 300 GeV cosmic electron from top leaves a short track in the left tracker and is detected in the middle tracker. The initial vertex is located in the middle tracker.

4 The Initial-Vertex Filter

The logic of the initial-vertex filter introduced in the last Riport is improved. The old and the current logic is shown in Table 1. By checking if the ACD tile on the extrapolation of the best track is hit, photons with an initial vertex on the tracker surface will be kept. The 2nd step of the filter is to cut electrons sneaking between tracker towers. This improved filter is expected to cut more electrons and keep more photons. A filter set similar to that in Table 1 in Riport 13 is applied. The result is shown in Table 2-4. In Table 2, the number of surviving photons successfully increases by 25 %, mainly due to the events with an initial vertex on the top layer. The difference of the effect between the two filter sets is not significant in the case of heavenly photons in Table 3. In Table 4, oops, the improved filter is not at all better than the old one. More electrons survives the new filter. What's wrong?

Table 1: The Initial Vertex Filter
A filter to cut electrons with an initial vertex on the surface of the tracker. The boundaries of trackers, 4 cm, 33 cm, 41 cm, and 70 cm are determined by eye from Fig. 4 in Riport 13.

Name	Old (Riport 13)	Current
Initial Vertex 0	Fit_z0 < 48	Fit_z0 < 48|| No ACD hit on extrapolation of best track
1	|Fit_x0| < 70 && |Fit_y0| < 70	(|Fit_x0| < 70 && |Fit_y0| < 70) || No ACD hit on extrapolation of best track
2		{4 < |Fit_x0| && (|Fit_x0| < 33||41 < |Fit_x0|) && 4 < |Fit_y0| && (|Fit_y0| < 33||41 < |Fit_y0|)} || No ACD hit on extrapolation of best track

5 To Do

- Investigate what kind of electron events survives the initial-vertex filter.
- Study the response of the calorimeter to high-energy events. Is a filter using the signals from the calorimeter to distinguish electrons from photons possible?

6 Correction

Fig. 1 in Riport 13 is incorrect. The correct one is in Fig. 8 in this Riport. The difference is at Fit_z0 = 0.

Table 2: Initial-vertex filter on 300 GeV photons onto the top
The top of the GLAST is illuminated with 300 GeV photons. The applied filters are described in Table 1 in Riport 13 except for the Best-Track filter, which cut events without a best-track detection.

	Old (Riport 13)		Current	
Generated	1	2000	1	2000
L1T	$(2.69 \pm 0.12) \times 10^{-1}$	537	$(2.69 \pm 0.12) \times 10^{-1}$	537
L2T	$(2.08 \pm 0.10) \times 10^{-1}$	417	$(2.08 \pm 0.10) \times 10^{-1}$	417
New L3T	$(1.805 \pm 0.095) \times 10^{-1}$	361	$(1.805 \pm 0.095) \times 10^{-1}$	361
Hi CAL	$(1.770 \pm 0.094) \times 10^{-1}$	354	$(1.770 \pm 0.094) \times 10^{-1}$	354
Best Track	$(1.300 \pm 0.081) \times 10^{-1}$	260	$(1.300 \pm 0.081) \times 10^{-1}$	260
Initial Vertex 0	$(1.260 \pm 0.079) \times 10^{-1}$	252	$(1.295 \pm 0.080) \times 10^{-1}$	259
1	$(1.000 \pm 0.071) \times 10^{-1}$	200	$(1.270 \pm 0.080) \times 10^{-1}$	254
2			$(1.215 \pm 0.078) \times 10^{-1}$	243

Table 3: Initial-vertex filter on heavenly 300 GeV photons
The whole GLAST is illuminated with 300 GeV photons with a heavenly origin.

	Old (Riport 13)		Current	
Generated	1	2000	1	2000
L1T	$(5.82 \pm 0.17) \times 10^{-1}$	1163	$(5.82 \pm 0.17) \times 10^{-1}$	1163
L2T	$(5.17 \pm 0.16) \times 10^{-1}$	1035	$(5.17 \pm 0.16) \times 10^{-1}$	1035
New L3T	$(4.21 \pm 0.15) \times 10^{-1}$	842	$(4.21 \pm 0.15) \times 10^{-1}$	842
Hi CAL	$(4.00 \pm 0.14) \times 10^{-1}$	801	$(4.00 \pm 0.14) \times 10^{-1}$	801
Best Track	$(2.98 \pm 0.12) \times 10^{-1}$	597	$(2.98 \pm 0.12) \times 10^{-1}$	597
Initial Vertex 0	$(2.81 \pm 0.12) \times 10^{-1}$	562	$(2.96 \pm 0.12) \times 10^{-1}$	591
1	$(2.72 \pm 0.12) \times 10^{-1}$	543	$(2.96 \pm 0.12) \times 10^{-1}$	591
2			$(2.83 \pm 0.12) \times 10^{-1}$	567

Table 4: Initial-vertex filter on heavenly 300 GeV electrons
The whole GLAST is illuminated with 300 GeV electrons with a heavenly origin.

	Old (Riport 13)		Current	
Generated	1	2000	1	2000
L1T	$(3.34 \pm 0.13) \times 10^{-1}$	668	$(3.34 \pm 0.13) \times 10^{-1}$	668
L2T	$(2.15 \pm 0.10) \times 10^{-1}$	429	$(2.15 \pm 0.10) \times 10^{-1}$	429
New L3T	$(1.735 \pm 0.093) \times 10^{-1}$	347	$(1.735 \pm 0.093) \times 10^{-1}$	347
Hi CAL	$(1.725 \pm 0.093) \times 10^{-1}$	345	$(1.725 \pm 0.093) \times 10^{-1}$	345
Best Track	$(1.440 \pm 0.085) \times 10^{-1}$	288	$(1.440 \pm 0.085) \times 10^{-1}$	288
Initial Vertex 0	$(9.45 \pm 0.69) \times 10^{-2}$	189	$(1.355 \pm 0.082) \times 10^{-1}$	271
1	$(4.95 \pm 0.50) \times 10^{-2}$	99	$(1.295 \pm 0.080) \times 10^{-1}$	259
2			$(1.200 \pm 0.077) \times 10^{-1}$	240

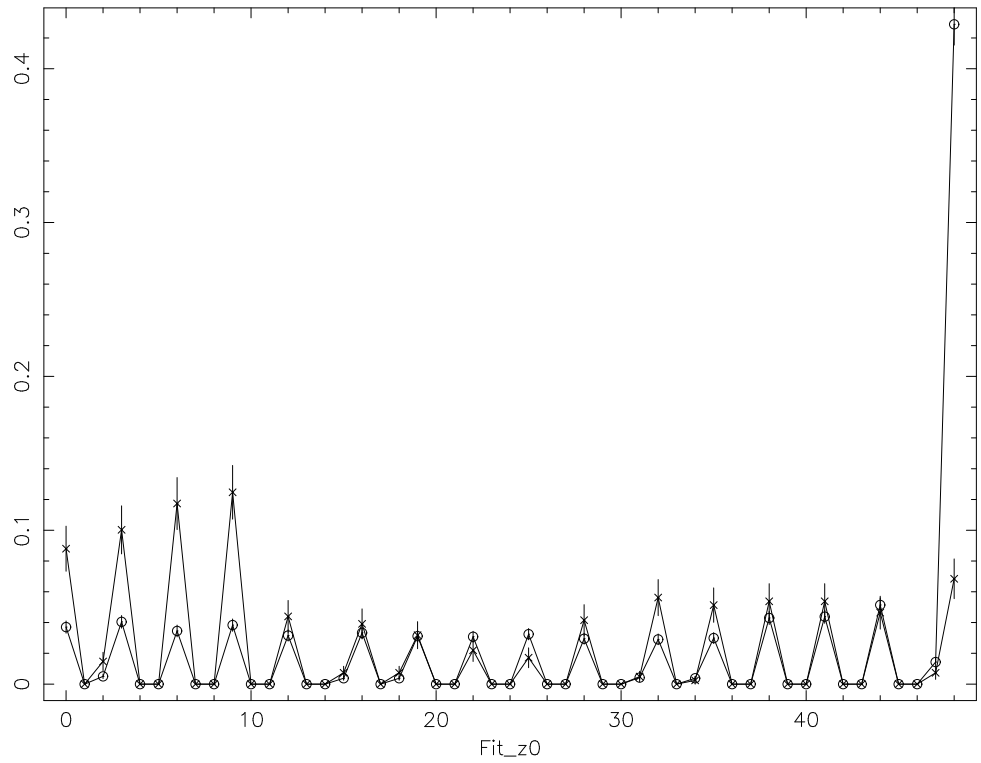

Figure 8: The distribution of Fit_z0
Corrected version of Fig. 1 in Riport 13. The distribution of 300 GeV electrons (◯) and 300 GeV photons (×) are plotted. The azimuthal angle was set to be less than 113°, i.e., a heavenly origin is assumed. Events without a best-track detection is removed.